du Treil, Lundin & Rackley, Inc.
A Subsidiary of A. D. Ring, P.C.

October 28, 1993

By Federal Express

Office of the Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Re: MM Docket No. 93-177

Gentlemen:

Enclosed are ten copies, including an original, of this firm's comments "In the Matter of An Inquiry into the Commission's Policies and Rules Regarding AM Radio Service Directional Antenna Performance Verification", RM-7594, MM Docket No. 93-177.

We are pleased that the Commission is undertaking this important inquiry and anticipate strong participation by the industry if a rule making on the subject if initiated.

Very truly yours,

Louis R. du Treil

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dLR 2248

Enclosures

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
An Inquiry into the	)	MM Docket No. 93-177
Commission's Policies and	)	
Rules Regarding AM Radio	)	RM-7594
Service Directional Antenna	)	
Performance Verification	)	

Comments of du Treil, Lundin & Rackley, Inc.

du Treil, Lundin & Rackley, Inc., (herein "dLR") hereby submits the following comments in response to the Notice of Inquiry in the above referenced proceeding. dLR and its parent company, A.D. Ring, P.C. have provided technical services to the broadcast industry since 1941.

I. Introduction

dLR applauds the Commission's initiative in opening this inquiry into how the present policies and rules, many of which had their origins over 50 years ago, might be modified to allow AM broadcasters to make use of modern technology and analysis methods in evaluating AM directional antenna performance. This firm believes that, with present-day technology, it should be possible to improve the Commission's ability to ensure that the directional antennas of AM stations operate properly, while greatly reducing their licensees' burden of paying for the services of technical consultants to perform lengthy procedures and prepare voluminous paperwork.

Following a presentation of general considerations and historical information, suggestions for topics to be explored in the rulemaking for the pertinent regulations will be presented section-by-section. In order that the changes proposed herein might be better understood by representatives of the broadcasting industry at large, a discussion of possible adverse concerns will be presented prior to the conclusion of these comments.

II. Background

Over the past 52 years that this firm has been providing technical services to the broadcast industry, many hundreds of AM directional antennas have been designed, adjusted, and measured for proof-of-performance by its representatives. The firm's staff members have closely followed the advances in science and technology related to AM antennas over the years and have been directly involved in the development process themselves.

Those with this firm who are currently involved in AM directional antenna adjustment and proof-of-performance work have adjusted many systems in recent years utilizing modern methods of computer modeling. From these experiences, it has become evident to us that the field strength measurement requirements of the present rules are outdated and that proof-of-performance reports are required to contain an inordinate amount of information. Most of the required information is not necessary to ensure proper directional antenna operation.

The costs of meeting the unnecessary requirements of the present rules are great. Repair, refurbishment, and modification projects which could cost in the hundreds or thousands of dollars instead have costs which total in the tens of thousands of dollars because of these requirements. This is a deterrent for the owners of stations who could better serve the public by making directional antenna pattern modifications, as well as those of stations with directional antenna equipment in need of repair and/or readjustment. No doubt many stations are operating today with malfunctioning antenna systems, and producing interference, out of their fear of the high costs of bringing in technical consultants to meet the proof-of-performance requirements of the present rules.

The reason that the present rules require so much unnecessary work is that their fundamental framework has not changed since the 1930s, when directional antennas were still being invented and AM radio stations provided the only over-the-

air broadcasting service. The methods of predicting directional antenna characteristics were crude at that time and only primitive equipment was available for monitoring internal array characteristics. The owners of the few hundred AM stations in operation at that time, who shared the national audience which is today shared by the many thousands of broadcast stations (AM, FM and TV) and numerous cable and satellite programming providers, obviously did not have to be as concerned about costs as do today's AM broadcasters.

III. Early Proof-of-Performance Requirements

AM directional antenna specialists first earned their reputation as practitioners of "black magic" back in the very beginning. Patterns were designed using the sinusoidal current distribution assumption (which is not too bad where far-field radiation is concerned) to make the pattern shape calculations straightforward. When it came to making directional antennas work, however, calculations which could be done using the methods available at that time were only able to provide reasonably good starting points for pattern adjustment. Considerable trial-and-error effort was often needed to find an adjustment which produced field strength measurements indicative of the proper pattern shape.

Upon completion of the adjustments, proof-of-performance field strength measurements were made. Out of concern for inaccuracies in the field strength measurement process (see section V of these comments), as well as array proximity effects, a great number of measurements were made. Once the desired pattern shape was confirmed by proof-of-performance field strength measurements, the element currents were measured and recorded to serve as an internal reference to evaluate the future stability of the array.

Currents were monitored because of the convenient, approximate relationship between the current in an array element and the field radiated by it. Element currents cannot be relied

upon to have exactly the same magnitude and phase relationships as the fields produced by the elements functioning in an array. Each element in an array simultaneously functions in radiating (with nearly sinusoidal current distribution) and receiving (with decidedly non-sinusoidal current distribution dependent on the terminal loading conditions) modes and its operating current distribution is a combination of the current distributions of the two modes. There was no way of calculating the combined-mode element current distributions at that time. Current samples bear at least some resemblance to the desired field parameters, though, and can be monitored to observe changes in the operating conditions of a directional antenna system.

IV. Base Current Readings

When the first AM directional antennas were built, there was no equipment available to measure the phase relationships of their tower currents. Thermocouple ammeters connected in series with the tower base feeds were observed. A tolerance of plus-or-minus five percent was established for the base current ratios.

Base currents were the only internal array parameters which could be monitored in the beginning, and a change in the true operating characteristics of a pattern could result in changes in their ratios outside the five percent tolerance. This was not true in every case, because the fields produced by the elements of a directional antenna are two-dimensional quantities and base current magnitudes are one-dimensional. It was not possible to monitor current phases, however, so the magnitudes had to do. Although thermocouple ammeters were notoriously subject to inaccuracy due to ambient temperature effects and changes in their internal characteristics[1], they were the best instruments available at the time for measuring RF currents.

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[1] Someone once described their function as measuring current with a thermometer mounted on a fuse.

V. Monitor Points

Lacking any better way to monitor internal array operating characteristics, regularly scheduled external field strength observations, even if subject to inaccuracy, were desirable. It became a standard requirement to select certain monitor points from the many field strength measurement locations at the time of a proof-of-performance. They were selected along the measurement radials considered to be critical; often toward other stations rather than at null azimuths. Field strength measurements were required to be made periodically at these locations and to be maintained below the maximum values assigned by the Commission.

Field strength measurements are subject to myriad influences having to do with groundwave propagation and local disturbances in magnetic field (AM field strength meters actually sample the magnetic component of field even though their meter scales indicate the far-field equivalent electric field strength). Seasonal effects (from frozen-ground winter conditions to dry, hot summer conditions) can cause monitor point field strengths to vary over a range of greater than two-to-one. If their limits are based on readings taken when conditions promoted abnormally high field strengths, monitor point observations made under normal conditions can seem deceptively low. If adjustments are made based on such readings, excessively high unattenuated radiation can result.

VI. Phase Monitors

Later in the history of AM directional antennas, "phase monitors" and remote tower loop current indicators became available. These units were the predecessors of today's antenna monitors. The requirement to read array element currents and phases was added to the requirements for base currents and monitor points. Stations were required to maintain the loop current ratios within five percent and the phases within three degrees. This was to provide a complex-plane current tolerance

of approximately five percent.[2] From this time on, stations were responsible for maintaining three internal parameters and one external quantity (base currents, loop currents, loop current phases, and monitor point field strengths) within their respective tolerances.

VII. Critical Directional Antennas

As the AM band filled up with stations, the question of loop current and phase tolerance was revisited, at least for stations unfortunate enough to file applications for facilities on the frequencies of well-to-do broadcasters who jealously monitored activity on their channels. Facing arguments that the new stations' directional antennas might theoretically cause interference to the older stations if the wrong set of simultaneous parameter changes happened to take place, the Commission created the category of "critical directional antenna."

For these stations, licenses were issued with parameter tolerances much more restrictive than for the others. For instance, a tolerance of 0.8 degree might have been placed on the phase of every element in a system because a study showed that such an excursion for one of the elements could theoretically cause interference. It was not necessary for the complainant to demonstrate that the phase drift of this element would ever occur in concert with the other element parameter changes to produce the condition of interference assumed in the calculations. It was not considered that the requirement for elements with much smaller field contributions, the ones that are more difficult to control, might not be justified at all.

This was done, in our opinion, without proper consideration of the nature of array parameter variation viewed in the light of

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[2] It can be seen from trigonometry that a three degree change in the angle of a vector will cause a complex-plane change of slightly over five percent, roughly perpendicular to the change which would result from a change in the vector's length.

signal propagation uncertainty. It seems ludicrous to us to require a station to maintain loop currents and phases within very tight tolerances for each array element all of the time because a set of parameters with small changes in ratio and phase could be found (without evidence that the simultaneous parameter changes would likely ever occur) to produce interference as defined by a model which predicts propagation conditions for ten percent of the time. Considering the fact that the directional antennas of many, if not most, of the stations in operation in the United States could be demonstrated to be "critical" using these procedures, the process has not been applied fairly, either.

VIII. Recent Trends in Regulation

In recent times, the FCC's rules have been changed to require modern equipment for sampling current ratios and phases, allow the use of toroid sampling devices at tower bases, upgrade the sampling system requirements and relax many of the labor-intensive operating requirements. The proof-of-performance requirements are still geared to the gathering of an enormous amount of external field strength information which must be included in a lengthy (and expensive to produce) report and stations are still responsible for maintaining all of the same internal and external readings that were established in the early days of AM directional antenna technology.

The process since the beginning has been one of layering on additional requirements as new technology has become available without reducing the burden of previous ones. For instance, was it still necessary to measure element base currents once remote readings of current ratios and phases became possible? Is it still necessary for stations with antenna monitor systems meeting the current rules to measure monitor point field strengths? Both are heavy burdens on AM broadcasters, even though the present rules do not require that they be read, because their tolerances are still specified and they are required to be within them.

IX. What do Proofs-of-Performance Prove?

As things stand now, technical consultants do a lot of expensive work running lots and lots of field strength measurements and making hair-splitting adjustments to control their values to within tenths of a decibel (herein dB). If we think that, just because we can read our field strength meters to within tenths of a dB, we can adjust patterns to produce the far-fields that protect other stations to that degree, we are deluding ourselves. The present requirements for directional antenna performance verification cannot define pattern radiation with that precision.

Full proofs of performance are subject to errors due to the complex electromagnetic environment that stations exist in, as well as to proximity effects which can be easily misinterpreted. Anyone who has adjusted and made field strength measurements on a directional antenna with deep nulls has probably observed scattering of field strength along a measurement radial spanning several dB. It is a mistake to assume that an adjustment to produce acceptable magnetic fields at the points that one decides to measure, compensating for local and, possibly, proximity effects, necessarily produces the desired far-field pattern. Adjustment to an entirely different set of parameters might produce excessive field strengths at these points while producing acceptable field strengths at other points along the radial.

The efficacy of proof-of-performance measurements to prove the real interference potential of directional antennas can be better understood by examining the information presented in the FCC memorandum concerning "Suppression Performance of Directional Antenna Systems in the Standard Broadcast Band" by Harry Fine and Jack Damelin, dated September 6, 1957. In this report (which was prepared before the advent of standard patterns), analysis methods to correlate measured and theoretical far-field skywave protection for a number of actual stations were examined. All stations studied were verified to be operating properly, under the rules, prior to the observations. A quadrature component of

9.0 percent of pattern RSS was found to produce standard errors in the range of four to six dB. Since the present standard pattern rules specify a quadrature factor of 2.5 percent (above a certain threshold), standard errors would be even higher if the 1957 data were analyzed under the present standards for defining patterns.

X. What do Partial Proofs-of-Performance Prove?

Partial proof-of-performance measurements are subject to additional difficulties. Since field strength measurements are analyzed with the original proof-of-performance as the standard, changes in the electromagnetic environment during the intervening time period can introduce substantial errors. Seasonal differences in ground conditions and changes in effective ground conductivity due to land development within ten miles of an array can result in errors on the order of several dB. Local effects, due to changes near the measurement points, introduce another layer of uncertainty.

Partial proofs-of-performance cannot prove that directional antennas function the same as they did at the time the most recent full proof-of-performance was run on them. In trying to do so, one encounters a margin of error that can be as high as several dB.

XI. Are Monitor Points Reliable?

Monitor point field strengths are subject to the same changes over time as partial proof-of-performance field strengths. It is possible for a station to conclude, from monitor point readings, that it is operating in accordance with the rules, even though the actual radiated field from the directional antenna might have strayed several dB from the value determined in the original proof-of-performance. On the other hand, it is also possible for monitor point field strengths to read high for the same reasons.

Most stations stopped reading monitor points on a weekly or even monthly schedule when the requirement for logging them was eliminated from the rules. Many stations stopped reading them at all. When monitor point field strengths are above their licensed limits today, with proper antenna monitor indications, it often means that either a seasonal change in effective ground conductivity or some new source of scattered field near the monitor points is at work. Even when the directional antenna pattern is in perfect adjustment, its licensee will have to spend thousands of dollars on partial proof-of-performance work to either move the point or show that the limit should be raised.

XII. What do Base Currents Show?

Most AM stations stopped reading base currents when the Commission dropped the requirement to log them about a decade ago. Many still have thermocouple ammeters in place at their tower bases. If they were to be read and found to be out of tolerance today, with correct antenna monitor indications showing, it would most likely mean that either their calibrations have drifted over the years or that they have been damaged by lightning. Those stations employing the more modern toroid sampling ammeters would probably not find that their calibrations have drifted, but many would discover lightning damage.

Woe unto any station operator with base current meters giving improper indications if one of the Commission's inspectors happens along. The ratio tolerances still apply, even though there is no longer any requirement for logging the readings.

XIII. Are Antenna Monitor Readings Reliable?

Antenna monitor readings, for stations employing approved sampling systems, are very reliable indicators of array stability. Stations that employ sampling loops on their towers, providing that their properties and those of the sampling lines used to connect them to the antenna monitor are known, can rely

on their antenna monitor readings as indications of the actual tower current relationships. Those employing toroid samplers at the tower bases can do so if the shunt effects at the tower bases can be accounted for.

We believe that, with proper modification of the sampling system requirements, the Commission can ensure that actual array operating parameters are monitored. The present rules provide for systems that can accurately monitor changes in parameters from those established at the time of a proof-of-performance. It will be a small step to provide for actual indications of ratio and phase using the same antenna monitors that are on the market and in use at most stations today.

XIV. Preparing for the Future

It is clearly time for a change. Many of the present directional antenna performance verification requirements are unnecessary. They can lead, though, to considerable maintenance expense for the licensees who wish to keep their facilities in total compliance with the rules.[3] The AM radio industry cannot afford these regulations in today's economic environment.

When this firm co-sponsored the original request for this Notice of Inquiry in 1989, it was our position that the rules should be changed to greatly simplify the measurement program and report requirements required for a proof-of-performance. We envisioned, based on our experiences with pattern analysis utilizing far fewer field strength measurements than are presently required for a proof-of-performance, that the rules could be changed to require less measurement work, and a simpler report, than required today for a partial proof-of-performance. The distinction between full and partial proofs-of-performance could, we thought, be eliminated. We also believed that the base

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[3] It is a temptation for some to risk a fine if an inspection occurs rather than take care of violations that would be costly to remedy.

current ratio tolerances of the rules served no purpose and could be eliminated.

We believed that these changes would be good for the AM radio industry, since the licensees of stations with directional antenna problems could much more easily afford to remedy them. Directional antenna pattern changes for coverage improvement could also be made more affordable under such a plan.

Our experience over the four years since we originally joined in petitioning for this Notice of Inquiry, considered along with our previous experience with modern computational techniques, has shown to our satisfaction that the computer software and instrumentation hardware available today make possible the satisfactory adjustment and maintenance of directional antennas without reliance on field strength measurement data.

We believe that a proof-of-performance report can be reduced to provide only information concerning the moment method model to predict the array parameters observed by the antenna monitor system, the design of the antenna monitoring system, measurements on the sampling devices and transmission lines, calibration information for the antenna monitor employed, information pertinent to the determination of operating power, a surveyor's certification to the tower alignment, and a certification from the technical consultant that the array and sampling system were built according to the submitted design and that the indicated parameters were adjusted to the calculated values.

We believe that the requirements for reading base currents and monitor point field strengths can be eliminated for AM stations meeting the new requirements and that the separate requirements for stations employing so-called "critical directional antennas" should be eliminated. A number of additional proposals which we believe would lead to AM improvement are presented in the section-by-section suggestions for rule changes appearing in these comments.

XV. Moment Method Modeling

The single most significant improvement in the state of the art to come along since the early days of AM directional antennas has to be moment method modeling. With moment method modeling, it is possible to solve for actual system currents and voltages to produce a desired antenna pattern. No longer is it necessary to make assumptions about the current distribution characteristics of elements in an array (see section III of these comments). Actual drive conditions can be accurately predicted for the desired pattern shape, instead of just an estimate of parameters to serve as the starting point for a trial-and-error adjustment effort.

Our experience with moment method modeling techniques for AM directional antennas goes back approximately ten years. Originally, we were interested in moment method modeling because of the advantages it offered for base impedance calculations and phasing system bandwidth optimization. As we began to tune new antenna patterns to the parameters predicted with moment method modeling, we noticed that the patterns measured before any field adjustment efforts were made agreed much more closely to the theoretical pattern shapes calculated by the methods specified in the rules than we had ever seen in the past. In some cases, no further adjustments were necessary prior to the proof-of-performance. In others, only slight differences were required. In no case have we found any indication of radiation that we would characterize as likely to cause objectionable interference, given the uncertainties of the proof-of-performance process (see section IX of these comments). We have successfully modeled arrays utilizing both guyed and self supporting towers, as well as both "top hat" and guy-wire forms of top loading.

If the Commission, in a Rulemaking, requests comments on the proposals presented herein, we believe that a great body of evidence will be submitted for consideration. This firm will devote considerable time and effort to providing the most up-to-date information available at that time. Others from within

the broadcasting community and outside experts who work regularly with numerical electromagnetic techniques will certainly provide valuable input to the process.

Although the techniques are relatively new to the AM antenna industry, moment method computer programs go back at least to the 1960s. Several modern programs are in the public domain today. Two of the most useful, NEC and MININEC were developed with United States government funds, and are available at nominal cost. Certain modifications and auxiliary programs, which are helpful for using NEC and MININEC to model AM directional antennas, have been the subject of technical papers presented at conferences and conventions.

NEC is a very powerful program, capable of analyzing extremely complicated antennas and environments. It can be used to model, for instance, the effects of real soil conditions on the far-field radiation characteristics of an AM directional antenna at angles above the horizon. MININEC is much simpler and will run on common office-type microcomputers (although slowly if a math co-processor is not installed). The later versions of MININEC solve simple problems, such as AM array elements over an assumed perfectly conducting surface, very efficiently. Since the present AM allocation rules are based on sinusoidal current distribution and perfect-earth assumptions for calculating antenna patterns, we believe that the additional features of NEC are unnecessary and that either program can be used to determine the appropriate parameters for a directional antenna. The allocation and pattern design requirements of the rules are not within the scope of this Notice of Inquiry.

XVI. Suggested Rulemaking Topics

73.14

Critical directional antennas should be eliminated. All stations should have the same parameter tolerances and be able to utilize modern antenna monitors. Better antenna monitors are

available today than those which were outfitted for the precision monitor adapters required to be installed by the stations whose directional antennas were designated critical.

73.44

The emissions requirements of the rules should specify that measurements of both desired and undesired signals be measured within the major lobe of an AM directional antenna. This will make the process much simpler than the one described in the rules. We believe that major lobe measurements should suffice to ensure that AM stations meet the requirements of the emissions rules.

73.45

The minimum field strength requirements should be eliminated. In the case of conventional nondirectional and directional antennas, their radiation shall be calculated according to the provisions of the present rules. For nonconventional antennas, the radiation predicted using moment method techniques with a loss assumption of one ohm at the maximum current point of each element shall be used. No field strength measurements should be required to establish the radiated field.

73.51

The rules should allow stations with negative resistance elements to terminate them into power-absorbing loads, determine the power lost in the loads, and consider it along with the common point input power to determine the antenna input power. This will allow substantial improvement in pattern bandwidth for many such stations, without penalizing them with poor antenna efficiency.

73.53

The reference to critical arrays should be eliminated (see 73.14)

73.54

The requirement to set directional antenna common point reactance to zero should be eliminated. The requirement for an impedance versus frequency sweep should be eliminated.

73.58

The requirements for measuring antenna base currents in directional antennas should be eliminated.

73.61

The requirement for monitor point field strength measurements should be eliminated.

73.62

The parameter tolerances should be the same for all stations. Special requirements for "critical" stations should be eliminated (see 73.14).

Comments should be sought on whether the tolerances for magnitude and phase of sampled base voltages (see 73.68) should be the same as they presently are for current samples.

73.68

Base voltage sampling for the antenna monitor should be allowed for any tower height. Moment method techniques make possible the precise prediction of base drive voltage relationships for elements of an array. Base voltage sampling, we believe, can be more indicative of actual pattern operation

than current sampling, as it is not subject to the effects of shunt currents (both displacement and conduction) across the tower bases.

If tower base current sampling is allowed, it should only be done where verifiable shunt effects can be accounted for in the calculation of operating parameters.[4] Comments should be sought on these issues.

Reference to critical directional antennas should be eliminated.

The requirement for a partial proof-of-performance following a change above any tower base should be eliminated. A full proof-of-performance should be required instead. Our proposed full proof-of-performance will be much less costly than is a partial proof-of-performance under the present rules.

The rules should specify the tests and measurements necessary to validate the antenna sampling system. We recommend open-circuit impedance observations at frequencies found to produce resonance[5] for the sampling lines, so that their lengths at carrier frequency can be scaled from the nearest resonant frequency, and impedance measurements at carrier frequency with the sampling devices connected for normal operation. The observations should be made at the antenna monitor ends of the lines. The impedances should indicate identical[6] loads with the sampling devices connected. In the case of tower-mounted, single turn, unshielded loops, this will indicate that their pickup characteristics are identical. In the case of base sampling

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[4] It might be necessary to restrict base current sampling to towers of certain heights and without certain types of circuits across their bases.

[5] Resistance determined by line losses and zero reactance.

[6] Plus-or-minus one ohm and two percent resistance and reactance.

devices, they will provide a reference for the devices' internal terminations.

Specific information on the acceptability of antenna monitor sampling systems should be in the rules.
73.151

The proof of performance should provide the following information:

1.) Information concerning the moment method model to predict the array parameters observed by the antenna monitor system

2.) The design of the antenna monitoring system

3.) Measurements on the sampling devices and transmission lines

4.) Calibration information for the antenna monitor

5.) Information pertinent to the determination of operating power

6.) A surveyor's certification as to the tower alignment

7.) A certification from the technical consultant that the array and sampling system were built according to the submitted design and that the indicated parameters were adjusted to the calculated values.

The requirements should be the same for all AM stations (the expanded band included).

73.153

The apparent conflict with the requirements of 73.185(a) should be resolved.

73.154

Following the changes suggested for 73.151, there will no longer be any need for a distinction between partial and full proofs of performance.

73.158

Deleted.

73.189

The minimum height and field strength requirements should be eliminated.

XVII. Possible Adverse Concerns

There is a certain hypnotic effect to doing the same tasks, the same way, over and over again for fifty-plus years. Radically new technology looming just over the horizon can often seem frightful, too. No doubt, objections have come to the minds of many of the readers of these comments as the proposed changes have been presented. We would like to share our positions on some of the concerns that we expect have arisen.

"If so many stations are out of tolerance, the rules should be made harder, not easier." - The fact is that our proposal should help this situation quite a bit. Changing the rules to turn a proof-of-performance into something like a one-day affair will actually help this situation in two ways. Stations will be much more easily able to afford the technical services they need and the Commission's field inspectors will be able to duplicate entire proofs-of-performance to aid in their enforcement efforts.

"Making proofs-of-performance simpler will make it easier for the devious." - In fact, deceitful practices will be discouraged. Much more effort and expense can be saved under the present rules if anyone is unscrupulous enough to falsify field

strength measurements. If the proposals appearing herein are enacted, this incentive for less-than-honest behavior will disappear. Additionally, it will be much easier for the Commission to check up on suspected violators.

"Moment method models cannot be trusted." - We believe that, if a Rulemaking is initiated to examine the proposals herein, the record will show to the satisfaction of all open-minded interested parties that monitoring and modeling methods can be specified which will provide interference protection no worse than would be the case under the present rules if all stations obeyed them.

"The proposals will make it impossible for technical consultants without great, big computers to do proof-of-performance work." - This is untrue. First of all, we believe that the necessary calculations can be performed on the average microcomputer. No secrets are involved in the moment method and auxiliary software employed by this firm and others who are doing such modeling today. The methods employed have been presented at public technical conferences. Market place forces should see to it that software packages with straightforward instructions will be available before the changed rules become effective, if they are enacted.

"The proposals will make it impossible for station personnel to do proof-of-performance work." - This is untrue. The station personnel who do not have the necessary computer equipment and software to do the calculations themselves could rely on the directional antenna equipment suppliers for the appropriate numbers. This situation would be similar to the situation for FM directional antennas today, where the manufacturers are responsible for their pattern-determining qualities.

"The proposals will cut into consultants revenues." - We hope that no one is motivated adversely by this concern.

XVIII. Conclusion

Rule changes similar to those proposed herein should improve the Commission's ability to know that our nation's AM directional antenna systems are functioning properly while greatly reducing the cost burden on their licensees. We estimate that proof-of-performance costs will decrease something like ten-fold if such rules are enacted.

We ask the Commission to give our proposals serious consideration and to include them soon in a Rulemaking proceeding.

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